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published in
New Contributions to Transportation Analysis in Europe
1999

document version
Publisher's PDF, also known as Version of record

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SERIE RESEARCH MEMORANDA

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Research Memorandum 1998-25

vrije Universiteit *ams terdam*

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1. Introduction

The main objective of the research' reported in this chapter has been to contribute to a strategic definition of the integration of the Trans-European networks and to stimulate thought on the development of methodologies for the assessment of performances of transport networks and for strategies for their development and/or integration. This very ambitious objective has arisen out of the realisation that strategic infrastructure networks have in the past been looked at as mainly physical networks. Although physical networks are important, in highly advanced economies it is other characteristics which are also important. We started by taking the five dimensions of the pentagon of concerns (Nijkamp and Vleugel, 1995) where finance, organisation and regulation, software and ecological factors are added to the physical hardware of the infrastructure.

The first stage of the research has been to concentrate on the necessary components of the evaluation process that includes all aspects of the infrastructure. The second main strand of research has been to examine these processes in more detail through specific case studies which focus of particular key elements within the EU. The chapter ends with the presentation of some more general conclusions on three cross-cutting themes which are at the core of integration, namely the links between networks and integration, appropriate methods for evaluation and analysis, and the contextual factors such as globalisation and internationalisation.

2. The Evaluation Framework

New perspectives on evaluation are important as individual links all form part of the network. In the past there has been little evaluation carried out at any level above the individual link where an improvement was taking place. We propose that evaluation should be carried out at three separate levels. In addition to the individual project level where the methods and procedures are well known (e.g. Nijkamp and Blaas, 1994), evaluation should be carried out at the programme and the policy level (Table 1).

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[1] This paper is based on work carried out by the COST 328 - Integrated Strategic Infrastructure Networks in Europe group over the last 4 years. We are grateful for the inputs of all members of COST 328 and of the four Working Groups. We are particularly grateful for the comments from the Chairman of COST 328, Michel Frybourg.

Different methods are required for programme and policy evaluation as it is important to establish how new links fit in with wider programme objectives (e.g. EU cohesion) and how Common Transport Policy objectives on sustainable mobility and the environment can be achieved. This means that analysis should not be restricted to particular sectors, or the functioning of the networks in particular well defined contexts. Eventually it could be extended to explore the implications for employment, the local and regional economies, the use of resources and the quality of life.

In addition to the multi sector analysis, individual links should be assessed in terms of their direct and indirect effects on the transport network. For example, the Channel Tunnel is a major new link between the UK and France and has a direct impact on the transport networks of these two countries. It also has effects on the economies of Kent and Nord Pas de Calais. However, the Channel Tunnel has impacts that are much wider, including those on the airlines and ferry companies (competitors), on freight distribution systems (efficiency) and on other countries (Belgium, the Netherlands and Germany). It is necessary to trace all these impacts as part of the evaluation process, so that the individual benefits of projects can be matched to the overall benefits viewed in combination - the superadditivity of projects and their contributions to programmes and policies.

Table I: Evaluation Processes

Evaluation Level	Evaluation Methods	Other Components in Evaluation
Project	Financial Appraisal Cost Benefit Analysis	Environmental Assessment Social Impact Analysis Economic Impact Analysis
Programme	Multi Criteria Analysis Framework Approaches	Ensuring that the individual costs and benefits of projects conform to wider programme objectives, particularly on regional development and environment.
Policy	Strategic Environmental Assessment Complex Objectives Analysis, including Meta Analysis	Fitting programmes into the national and international policy context, so that broad economic. social and environmental objectives are met

In addition to evaluation processes, there are important implications for decision making processes more generally. Throughout this research, there has been a concern over the critical success factors within the European network of transport links and how value can be added to the network. Again, it is proposed that a three level approach be adopted that attempts to identify both the critical success factors and the nature of the added value (Table 2). In the past, most attention has been focused on individual links, terminals and interchanges, often only for one mode of transport. At this local project level, it is argued that the critical success factors for added value would include the availability of finance, the commitment of different individuals (actors), and the levels of integration available (e.g. information and data support systems).

At the programme level, the broader issues of logistics and network connectivity become more important in determining the levels of intermodality, interoperability and interconnectivity. Here again, the critical success factors depend on the availability of finance and the linkages between companies. Financing is often perceived as a

problem, but worthwhile projects and programmes will be financed if there are clear benefits. Difficulties are more likely to occur in the organisational and regulatory framework within which transport has to operate as competition is limited by some modes not paying their full social costs. Investment in one location or for one mode may also crowd out other initiatives, and this in turn has implications for efficiency. The means to reduce levels of uncertainty and to permit continuity in finance and investment seem to be the two key conditions for success here.

Table 2: Decision Making Processes

Level of Decision	Key Issues	Critical Success Factors
Local - Project	Individual Links, Terminals, Interchanges for Each Mode of Transport	Restrictions, Competition between Modes. Finance and Subsidy, Individuals, Levels of Integration - *adding value to links and nodes*
National - Programme	Logistics and Network Effects, including questions of Intermodality, Interoperability and Interconnectivity, including the crowding out of investment	Regulation, Competition. Finance (public and private), Companies, Integrators, New Actors, Mergers and Alliances - *adding value to the network and communications*
National and EU - Policy	Competitiveness, Cohesiveness and Environment, but also pricing competition. liberalisation and open access policies.	Regulations. Competitive Frameworks, Financial Institutions, Governments, International Agencies, Multinational Companies - *adding value to the competitive position of countries and the EU*

It is at this scale of activity that new actors and integrators have appeared in the market to assist in obtaining the greatest efficiency from a given (or enhanced) network. The importance of the new technology in facilitating this process cannot be underestimated. In addition to the instrumental role played by technology, the restructuring of companies and the globalisation process (through mergers of companies and alliances between companies) has meant that the use of the network has increased over and above the expected levels. The high quality transport infrastructure has facilitated the use of the new technology and the globalisation process. This is the value added.

At the EU and national policy levels, the transport network in Europe has an important role to play in moving towards the objectives of balanced competition, social and spatial cohesion, and environmental objectives. A high quality network is also a crucial element in maintaining and enhancing Europe's position in the world as well as ensuring regional development objectives and social inclusion. It may have a less important role in achieving environmental or sustainability objectives as transport is a major consumer of resources and producer of pollution (Banister, 1998).

The critical success factors here are the clear support of financial institutions, governments, international agencies and multinational companies in ensuring that the competitive position of the EU is maintained and developed. It is in the interest of all parties that the use of and access to the network is efficient and equitable. This requires agreement on priorities, on investment and on the means to pay for the use of that infrastructure. It is here that the decision processes are sometimes inconsistent,

and the means to finance investment or to charge for the use of the infrastructure needs to be established.

In the past, a demand led approach has been followed with heavy investment in the network to meet expected growth. This approach has been modified through management based policies (traffic management and more recently demand management), but even here inefficiencies are increasingly occurring as demand continues to grow and congestion is created. New strategies are required that mix both the physical and financial options in combination with the opportunities that spatial development strategies and technology offer. Location policies and the increasing use of telecommunications can reduce the demand for travel so that the use of the network is improved (Banister, 1997; Salomon, 1995).

In summary, it is important to make evaluations of new links, particularly strategic ones, at different levels. It is also important to include *a wider interpretation of links and networks* so that the supporting infrastructure (finance, regulation, competition, organisational factors, communications etc.) are also included. *The dynamics of the processes* are both interesting and informative, as the use of networks has changed radically, as businesses and people react to congestion and new opportunities Underlying much of these changes are *the decision makingprocesses* used by all interested parties at all levels. Further investigation is merited of the actors and the critical success factors. As a result of these preliminary findings, a more detailed investigation was carried out along four separate dimensions where it was expected that the actors and the critical success factors would be found - these were peripherality and accessibility, Trans Alpine freight transport, competition and complementarity, and the role of actors.

3. The Case Studies

3.1 *Peripherality and Accessibility*

Background - The drive towards the completion of Trans-European Networks (TENs) as an instrument in the removal of barriers to a more competitive infrastructure network in Europe, and a promoter of greater cohesion, has emphasised the role of improving accessibility with implications for Europe's more peripheral regions. It is, therefore, clear that any attempt to improve the evaluation and policy making process for infrastructure networks in Europe, has to address the problems posed by the less accessible and more peripheral regions. This raises sets of questions, both for the peripheral regions, and for European level decision making.

At the European level, there is clearly a difficult balance to be struck between those improvements which are seen to be necessary for the greater development of competitiveness of the European Union as a whole, and the recognition that these may imply an uneven development of networks (Vickerman, 1998). It is tempting to believe that this issue can be addressed through the development of a set of indicators which can capture both of these dimensions. The search for a perfect indicator of accessibility is thus a key element of the development of both the evaluation process and the policy making procedure. We return to this point below.

At the national level, the more peripheral countries of the EU also face some difficult issues. The peripheral countries are those which generally enjoy infrastructure which is both less well developed as a total network, and poorer in the quality of service it offers. This can be measured by the density of both the road and rail networks, and such indicators as the proportions of the road network which are motorways, the extent of electrified rail track, or double track railways. It is also found in the development of airport and port networks. With the latter, the level of service is seen to be particularly important, with lower densities of services linking these regions to the core regions of Europe, customers facing less frequent services, less direct services and higher prices.

The peripheral countries also face problems within their national territories. The distribution of accessibility varies substantially, typically between their major cities, and more distant poorer rural regions. The choice facing these countries is one of an appropriate distribution of resources between the development of the infrastructures at the higher European level, which will tend to increase inequalities within the country, and to concentrate on raising the level of accessibility in the poorest regions,

Accessibility Indicators - It became clear that the variety of experiences in peripheral regions made it unworkable to determine a single universally applicable indicator of accessibility, despite the advances which have been made in the definition of accessibility over the last few years (Vickerman, 1995; Spiekermann and Wegener, 1996). Indicators still tend to be either geographically, or mode, specific. The varying geographic circumstances of the European periphery, ranging from the sparsely populated Nordic countries, through the outer peripheral Atlantic Arc, into the Mediterranean, to Greece and the eastern periphery, clearly poses a major problem for any attempt to define a single accessibility indicator. Critically, improvements in accessibility cannot be unequivocally taken as an indicators of improvements in economic performance or welfare. Thus simply improving the absolute accessibility of a peripheral region does not guarantee improved cohesion within the EU, and may in fact reduce cohesion.

A key factor which emerged during this part of the work was the concept of linking accessibility to that of choice. In all dimensions of travel and transport choice structure, peripheral regions face a more restrained offer, and greater constraints than those in the European core. This choice affects the availability of modes, the range of destinations served directly, or with a single interchange, and perhaps most significantly, the range of choice and competition between different operators and carriers. Defining accessibility thus becomes a question both of a range of factors, and the behaviour, particularly the competitive behaviour, of actors.

Case Studies - In order to develop this concept further, a series of four case studies was undertaken by different members of the group on contrasting peripheries.

- The Nordic countries demonstrate the problems faced in sparsely populated regions which also suffer major physical barriers of sea links to the rest of Europe, whilst at the same time being close to a number of the countries in transition in eastern and central Europe.

- Ireland represents the particular case of an island nation highly dependent on sea and air links, with the particular concern that it faces a choice between longer sea routes to the European continental mainland, or a sequence of shorter crossings, using the routes through the United Kingdom.
- Portugal, like Ireland, is part of the outer periphery of the Atlantic arc, dependent on links across another member state for its connection by land to the European core, but with strong sea trading links outside the European Union.
- Spain is an example of a country with substantial variations in regional degrees of peripherality, but strongly affected by the growth of one industry, tourism.

Summary of Findings - These four studies emphasise the variety of accessibility experiences in different parts of the European periphery. Tables 3 and 4 provide a summary of these findings in terms of the evaluation processes, and decision making processes identified above.

Table 3: Evaluation Processes with respect to Peripherality and Accessibility

Evaluation Level	Evaluation Methods	Other components in Evaluation
Project	*Financial appraisal and CBA* - Financial appraisal limited given traffic flow levels; need for careful analysis of wider economic factors in CBA; reliance on accessibility indicators can be misleading; many regions already have healthy economies which are protected by inaccessibility rather than constrained by it	*Environmental assessment* - new physical infrastructure may be seriously ecologically damaging in some remote regions; *Social impact analysis* - some remote regions may have fragile social structures where greater integration is damaging; *Economic impact analysis* - difficult problem of evaluating appropriate forward and backward linkages arising from new transport infrastructure
Programme	*Multi-criteria analysis and framework approaches* - needs a view of overall development of economy to ensure consistency with infrastructure programme, need to consider non infrastructure aspects of transport on consistent basis with physical infrastructure.	*Need for clear objectives on regional development and environment* - programmes must avoid being too oriented to international links to the exclusion or detriment of internal distribution impacts
Policy	*Strategic Environmental Assessment and Complex Objectives Analysis, including Meta Analysis* - need to ensure that transport is treated consistently and transport policy is not being asked to shoulder too large a burden of non-transport objectives (e.g. employment creation through construction) and that non transport policies have been adequately assessed for their transport impacts (e.g. other spatial development policy, regional policy, rural development policy etc.)	*Programmes in national and international policy context so that broad economic, social and environmental objectives are met* - A better understanding of the role of transport in the development of the economy and society, especially the distribution of the benefits of growth and economic development, better understanding of the link between economic growth as measured by GDP and welfare (including distributional, social and environmental factors)

Table 4: Decision Making Processes with respect to Peripherality and Accessibility

Level of decision	Key Issues	Critical Success Factors
Local - Project	*Individual links, terminals and interchanges for each mode of transport* - need to determine most appropriate mode for many regions where conditions do not allow for choice, need to decide between complementarity or competition with adjacent regions (e.g. competing airports or developing surface link to airport in neighbouring region). but intermodality may offer an alternative.	*Levels of integration (adding value to links and nodes), finance - individuals* - the need to improve choice, concern about the burden of financing new infrastructure on individuals in sparsely populated areas, cost of tolls, fiscal burden, need for evaluation of relative benefits to local area and to external areas from scale economies. forward and backward linkages etc.
National - Programme	*Logistics and Network Effects/Intermodality, interoperability and interconnectivity* - decide between network choice or preferred network development strategies. problems of linking peripheries directly or through core hubs. crucial role of the design and structure of networks ("network architecture")	*Companies, integrators, new actors, mergers and alliances (adding value to network) - public and private finance* - similar concerns as at local level on incidence of toll and fiscal burdens, need for analysis of "appropriate" network by mode for each country, concern about monopoly power of (often foreign owned) new actors and integrators, which act as limit to choice.
National and EU - Policy	*Competitiveness, Cohesion and Environment/ Competition, Liberalisation and Open Access* - fundamental conflict of competitiveness thrusts involving the search for scale economies and simplistic cohesion objectives, contradictions in accessibility indicators. Problem that competition and liberalisation requires flows large enough to achieve minimum cost operations by all operators. need for new small scale low cost alternatives	*International agencies, multinational companies (adding value to national and EC' competitiveness), institution and government finance* - balance between available Structural Fund and EIB finance and fiscal burden/crowding out effects, distributional concern about competitiveness/ cohesion balance, need to identify comparative advantage of peripheral regions in external trade of EU e.g. through ports, development of major "transition" corridors, i.e. choice of destination/trading partner

Three particular factors stand out from this which are crucial to future development in the periphery. Firstly, there is the balance between links and networks, and the critical position of key hubs. This affects the way in which local and regional networks within peripheral regions relate to the higher level European networks. It requires a clear understanding of appropriate markets and the threats posed, wittingly or unwittingly, by actors in other regions. Such market opportunities and competitive threats are often sector specific and relate to the existence of scale economies and to the scope for the development of backward and forward linkages within the regions.

Secondly, there is the relative importance of competition, both between and within modes. This requires a clear view of the way in which networks are to be viewed as

competitive or complementary recognising the typically lower level of flows in peripheral regions, However, some peripheral regions in the EU may face substantial transit or corridor traffic to and from external borders of the EU or ports. Within modes the lack of competition between carriers and the relation of domestic to foreign carriers in strategic alliances may pose particular problems for peripheral regions. This includes the need for reliance for key links on hubs which are controlled by others.

Finally, there are the potential problems of the excess burden of new infrastructure on activities within peripheral regions. New infrastructure provided by the private sector or otherwise requiring the payment of tolls may place extra burdens on the local economy. The replacement of, for example, traditional low cost ferry routes by a new bridge or tunnel may reduce travel times and their variability, but at a high cost to local users. Even where direct charges are not made and where external subsidy is available through the Structural or Cohesion Funds or through EIB loans the local community will have to bear at least a share of the cost which places either or both a fiscal burden and some crowding out on the local economy. Thus the total costs to the local economy are not reduced by the extent which a simple measure of the enhancement of accessibility might imply. In this case neither competitiveness nor cohesion are improved.

For the development of an evaluation methodology the following features are critical. The pentagon of concerns identities the variety of issues which are present in all regions, but the lack of choice in certain dimensions creates particular tensions for its use as an evaluation tool in peripheral regions. The structure identified in Tables 1 and 2 has been applied to our analysis of the peripheral regions, based on the four case studies. This does highlight the way in which the lack of choice and factors such as crowding out effects and the excess burden of new infrastructures act as critical success factors. However, it is too simplistic to think of these cases falling neatly into the cross tabulation. There are clearly factors which cut across the issues identified here.

A major issue is the role of actors. In peripheral regions these actors often come from outside the region, or are dependent on other actors outside the region. This blurs the neat distinction into local, regional and national decision makers. Projects in peripheral regions which may have significant effects on local communities, such as the construction of bridges in coastal regions or new roads into inaccessible mountain areas are typically not viable as free standing projects, but only as part of a network of new developments. The benefits from a single project can only be realised in full if other projects (often in other regions) are undertaken. It must be evaluated together with the socio-economic development which it has to support. This superadditivity effect makes it difficult to ascribe precise costs and benefits.

3.2 *Trans Alpine Freight Transport (TAFT)*

The TAFT context - The structure of production, distribution and transport is going through a rapid transition phase. Globalisation, outsourcing and just in time delivery are trends that lead to an increased demand for freight transport on the one hand, and to a change in the kind and quality of services demanded on the other. At a European level, these trends are reinforced by the political and economic process of integration and the increase in spatial interaction. The consequence is an increasing stress on the transport networks in form of congestion and bottlenecks.

The policy responses to these problems are inadequate and in many cases national regulations are at the source of the problem, for example the Trans Alpine freight transport. But TAFT is not an outcome of market processes alone. On the contrary, the ways in which overall flows are split among the modes and the country is to a very large extent the result of policy intervention in different countries. In the case of Switzerland, the overwhelming role of rail freight, and especially combined transport, is produced by the regulation of road transit (28 tonne limit) and subsidies for piggyback transport.

What generally holds for the European networks is even more true for the Trans-Alpine freight transport networks. TAFT is characterised by spatial frictions at national borders, incompatibilities between transport modes, capacity problems on roads, lack of competitiveness on rail, and environmental problems.

Objectives, Approaches and Evidence - The TAFT group analysed problems of network integration in the Trans Alpine context by focusing on the functioning of the network rather than on its overall social impacts. This more narrow perspective permitted concentration on network efficiency and deficiencies and thus the identification of the critical actors and success factors.

The functioning on the network has been considered with respect to the five pentagon dimensions namely: infrastructure (hardware), software, market organisation and regulations, environmental and financial aspects (Nijkamp and Vleugel, 1995). Analysing the functioning of the TAFT network with respect to the five dimensions implied the use of a variety of methods and instruments.

Hence, instead of developing a unified evaluation tool for overall impacts a sets of context, specific tools have been applied to evaluate various cases of malfunctioning. More specifically, the group used the following approaches in the different contexts:

- Micro level (individual actors behaviour).
  - Stated preference analysis of freight forwarders' behaviour.
  - Policy network analysis.
- Aggregate level (network flow models).
  - Mode choice and freight distribution models.
  - Neural network models.
  - Qualitative flow forecasts.

The applications of this diversity of methods produced a number of significant results with respect to singular aspects of TAFT. The research illustrates how various influences, including national, rail, environmental and political forces are all preventing

progress towards better use of the infrastructure. This in turn results in a focus on big infrastructure projects, which are only limited by increased funding problems.

The general approach outlined in Section 2 concentrates on value-added use by actors of infrastructure which is itself passive. In line with this approach, TAFT has been viewed as flows, for which the modal links are part of the hardware, but other elements are also involved. There are significant differences in the features of flows by the various transalpine routes, as well as modal split between rail and road (Maggi, 1992). Switzerland serves predominantly rail freight, while road use is concentrated on the French and Austrian routes. Combined transport has begun to play a role, mainly through Switzerland.

Infrastructure is not yet a bottleneck on the routes concerned. Although there is some road congestion, there is theoretically a substantial capacity reserve which could be activated under other circumstances, such as reductions in regulatory restrictions. Although financing is clearly a barrier to realisation of substantial new links, which may be justified for other reasons such as ecological requirements or organisational shortcomings, this is not seen as a basic barrier to optimisation. The ongoing survival of some combined transport links is not a financial problem, but rather an organisational matter, since subsidy is an aspect of regulatory intervention on market functioning.

The conclusion reached is that the most critical barrier to efficient network integration in the Trans Alpine sector is organisational. Two features of the findings are highlighted here. Firstly, the TAFT market is over-regulated. National, regional, local and mode-specific interests dominate over the interest of serving transport problems in an integrated way. This regulation reduces the capacity of the network through disintegration. Secondly, the national dimension has a negative impact on TAFT network integration. Most suppliers are local monopolies, and a market structure orientated on the national market dimension has developed. This results in small fragmented operators with inefficient use of scale and market access is difficult.

The TAFT studies suggest that the European discussion on the separation of track and operations reflects the need of free access because it is the only way to make competition work, even though in economic terms it is doubtful whether such a disintegration returns higher efficiency and profit than an integrated operation. The existing 28 tonne weight restriction in Switzerland and the ban on night goods vehicle driving has been shown to have an impact equivalent to a 20% price difference, but to provide no incentive to greater efficiency, so inducing the known detours through France and Italy. The existing environmental capacity is used less efficiently. Pricing schemes with fixed and variable elements have an incentive to lower other costs and improve competition.

Critical Success Factors (CSFs) ▪ The critical success factors and the relevant actors found in the research can be listed according to the pentagon of concerns. From the results here, improving the functioning of the TAFT network primarily implies improvements in terms of regulation and market organisation.

More specifically, the research pointed out that *Hardware* is not seen as a scarce factor. Moreover, route and tunnel construction only creates potential, but does not itself improve efficiency. Critical actors in this field are national governments which define infrastructure strategies from a national perspective rather than taking a European view of Trans Alpine infrastructure needs and respective funding options.

Orgware (organisational and regulatory issues) are shown to be critical. After an examination of several alternative approaches, it was concluded that it is critical to improve the competitivity of both the rail and the combined transport sectors, by intrinsic improvements following the removal of existing barriers. These include addressing the problems of national monopolies, inadequate internal flexibility, lack of market orientated behaviour, and confusion of aims through the superimposition of national policy goals - these are the critical success factors.

The available instruments are in general terms re-regulation, privatisation, market opening at a European level and free access. The last of these is the most relevant for the promotion of integrated and inter-modal transport. Present operators cannot provide competitive services in today's fragmented market. New entrants require freedom from national policy restrictions and from a dependent relationship with existing railways. Clear rules for infrastructure use, market access, property rights for basic service providers, and an international harmonisation of norms would have an enormous impact upon integration of the networks.

The most feasible approach is probably deregulation, removing existing rules without imposing new rules. This would encourage new partnerships and a more incentive-oriented approach. It is in the orgware domain where we find most of the critical actors. These are the national railways, the national combined transport companies, the road transport sectors which all in one way or in another profit from the current overegulation of the TAFT market and the subsequent disintegration of the TAFT network. In addition, regulatory agencies have a limited knowledge of alternative modern options for re-regulation and also a limited interest to implement them.

Ecoware (Ecological aspects) has a role to play in that it is at present one of the sources of distortion of choice, and that the concept of ecological capacity is thereby introduced - but this is also a part of the organisational environment. The environmental interest groups represent another set of critical actors in so far as they combine, especially in the TAFT context, narrowly defined local interests with more general environmental concerns.

The other two components of the pentagon of concerns are less important. *Software* has a particular role for rail and combined transport, where open harmonised systems are not yet operational, but this is not seen as a leading critical success factor. *Finware* (Finance) is not seen as a primary barrier to raising efficiency. However, this does not mean that there are no major investment proposals in the TAFT region. There are four tunnel proposals (two in Switzerland, one in Austria and one in France), each of which requires substantial investment. The costs will be borne bilaterally by the connected countries, but the benefits will be spread much wider across Europe. The argument here is that if the project is agreed, the financial package will be put together, but the main barriers to implementation are organisational.

Presenting critical actors and factors this way makes it obvious that actors' behaviour cuts across the logic of the pentagon of concerns. But one important finding is that actors play a strategically critical part in the sphere of regulation and market organisation.

Summary - The TAFT market fails to function efficiently due to various policy failures. First, transport policies have been and are still following a national logic. Regulations in the transport sector on a national level together with national planning perspectives of the infrastructure hinder the emergence of an integrated TAFT network. Secondly, policies which have been designed in the interest of national players, such as railways and combined transport companies, are only slowly giving way to an integrated European approach. Thirdly, the newly arisen focus on environmental issues leads to un-holy alliances with the already existing interests. This leads to a situation where different stakeholders strongly support a transport policy focusing on national issues. Under these circumstances, the policy options are severely limited.

These results have been achieved through the application of a variety of methods and a synthesis of the evidence found. Aggregate flow models allowed for the quantification of the overall implications of specific strategies (e.g. the 28 tonne limit), whereas microeconomic analysis has given more precision to strategic potentials in terms of price strategies for forwarders. The combination of this evidence has helped to identify critical success factors. Introducing actors analysis has permitted specific weights to be given to these factors in terms of relevant actors in the case of specific bottlenecks. Finally, the organisation of the arguments according to the pentagon dimensions has given a coherent overview on the findings. Thus, the pentagon perspective has been used as a reference for in terms of critical dimensions of the issue and not as an analytical device – which it is not.

The conclusion is that, in contrast to earlier expectations, organisational issues form the key critical success factor for improving the opportunities of network integration on the Trans Alpine freight route networks. These findings are clearly not only confined to the Alpine routes, but their significance in the concentrated, highly political, and highly competitive environment of the Trans Alpine range is to be noted

3.3 Competition and Complementarity

Background - Recent policy developments in the European transport sector suggest a high degree of deregulation, accompanied by and reflected in a trend towards decentralisation and privatisation. The general view is that the market ought to have a more pronounced place in transport decision making. A market system implies by definition more competition in order to increase the efficiency of formerly bureaucratically organised, over-regulated transport systems (e.g. in aviation, railway operation, or inland waterways transport). However, at the same time, a drive towards the market may encounter two major stumbling blocks which would have to be overcome in order to achieve an efficiently operating market system. Firstly, there is the danger that as a result of market competition a transport system will emerge that is fragmented horizontally (particularly between modes), which suffers from lack of

network synergy, critical mass and complementarity between different modes which altogether make up a socially desirable transport system. Secondly, there is the danger that a strict obeyance to market principles will favour those transport modes which are economically most efficient, but fail to incorporate the social costs accruing from externalities such as environmental decay, congestion and fatalities.

The main aim of this case study on Competition and Complementarity in Road, Rail and Waterway (CoCoRoRaWa) transport was to set out the principles for an evaluation methodology in the transport sector, by investigating systematically the usefulness of the pentagon of concerns for policy assessment regarding the competitive-complementary of transport decisions. An important focal point of this working group was to identify and develop relevant evaluation frameworks and operational assessments methods in order to judge the socio-economic meaning of extensions or adjustments in transport movements in Europe.

This analysis is crucially important as transport mobility has drastically increased in Europe. For example, in the period 1980-1 990 freight traffic in Western Europe has risen with approximately 30 per cent. Car ownership has increased with some 40 per cent, and passenger traffic with approximately 35 per cent. The political developments in Central-and Eastern-Europe leading to a widening of the European transport market and the increasingly recognised need to take care of the environmental stress of the transport sector make it necessary to develop an evaluation system that would incorporate mobility changes, modal shift and environmental constraints in the mobile Europe. Thus, a balance has to be found between efficiency, equity and sustainability.

Objectives and Approach - The objectives of the CoCoRoRaWa case study was to develop a systematic, comparative assessment methodology for road-rail-waterways competition and complementarity regarding intermodal transport in Europe, mainly seen from an actors' perspective in a liberalised transport market. A secondary objective was to position the actual passenger and freight development in a contestable European transport market by means of suitable and measurable indicators depicting the strategic demand and supply characteristics of the evolution of this market. From these two basic objectives the study then develops a cross-modal and cross-national comparative analysis for the performance of various modes and their actors.

The CoCoRoRaWa case study has also made an attempt to establish methodological and applied links with the general evaluation approach (Section 2). This has been achieved through the focus on multimodal issues in Europe, with specific attention on the identification and operational definition of indicators for the measurement of integrated European network performance. Attention has also been given to the issue of synergy in European networks by paying attention to the efficient operation (added value) of interoperable networks, and to the analysis of the role that different (new) actors play in the European transport market, with a specific view on the strategic role of market-based initiatives in freight transport (including social costs).

Three methods have been used in the CoCoRoRaWa case study. Firstly, policy scenario analysis has been developed, based on exogenous futures, sustainability policies, and infrastructure options. Secondly, an assessment of bottlenecks in European transport via a strength-weakness analysis and an analysis of critical success

factors for multimodality (based on the pentagon approach) have been undertaken. Finally, a survey-based and actor-oriented methodology has been developed for setting priorities in intermodal freight transport infrastructures in Europe. The pentagon prism introduced above was used as a general framework for setting up the methodology and for undertaking the empirical studies.

Analysis and Results - The methodological and empirical work was undertaken in two different, but complementary approaches. Firstly, using the five critical success factors encapsulated in the pentagon of concerns, a European survey was held among transport experts in order to identify the bottlenecks and the most promising elements of European intermodal transport policy, in particular regarding freight transport by rail and road. It turned out that financing and organisation were by far the weakest elements in a coordinated European multimodal policy. This means that in future multimodal infrastructure network plans such aspects would need prominent attention. Secondly, a European commodity flow study on road-rail competition was carried out by maximising the benefits of network synergy in Europe. Here neural network analysis turned out to be a fruitful analytical tool. In addition, the environmental costs were introduced by assuming various user charge policy scenarios for European freight flows. Clearly, the implementation of such market-based environmental policies will have an impact on the spatial distribution of flows, but does not lead to a dramatic decline in transport flows.

The assessment and evaluation framework outlined above has been applied to the assessment of the efficiency and the state of transport modes in Europe and of the network as a whole. This has been pursued at two levels. First, the technical elements and their operational aspects have been evaluated. Secondly, the operational-managerial characteristics (environmental, economic, service/network) of a "good' or satisfactorily operating freight transport network have been assessed. Such desired trends have been defined for each mode and for the entire system.

At the more disaggregate level, this case study has tried to trace, identify and assess the decisive barriers that prevent a well-functioning operating of the freight road-rail network. These factors have again been traced at two levels, namely the national level and the European level. In addition a distinction between intermodel transport lines and terminals has been made. The issue of achieving a satisfactory freight transport network has also been examined. For designing the necessary policy the crucial success factors have been carefully studied and their relative importance systematically assessed. For the identification of both current barriers and success factors the pentagon of concerns has again been used (Table 5).

The conclusion reached is that the development of a well functioning multi-modal transport framework emerges as a promising solution for several current transport problems and related externalities. However, it appears that the existing state of multi-modal networks is lagging far behind the desired level, especially in the case of road-rail cooperation. The survey exercise performed in the framework of the present study showed thus clearly that transport experts in Europe attach a high desirability to the development of an efficient and effective multi-modal network, and this will be beneficial to the transport sector and society as a whole.

Table 5. Survey of the Results

	Crucial Barriers	Medium Barriers	Low Barriers
Gap between existing and "desired" intermodal transport. National level	financial hardware	organisational	software psychological meta-variables
Gap between existing and "desired" intermodal transport. European level	financial hardware		organisational software psychological
Gap between existing and "desired" intermodal terminals. National level	financial hardware		software psychological
Gap between existing and "desired' intermodal terminals. European level	financial hardware	organisational	software psychological

However, this evolution is burdened by serious obstacles. It seems that there are prohibitive financial, technical, organisational and other problems. In particular, the cooperation level between European countries for the development of a fully interoperable railways system is rather weak at present. Moreover, railways have an important role to play in the development of an effective network. Other technical problems, such as those related to the existence of specific rolling stock emerge as a decisive barrier and should be taken into account. Financial issues involved in the creation of sufficient rail infrastructure and intermodal terminals seem to be a rather prohibitive obstacle in almost all European countries and relevant institutions.

On the other hand, the importance of proper inter-modal terminals is considered as fundamental by most European experts. They indicate that there is a great lack of intermodal terminals which otherwise could facilitate an effective rail-road network. The development of proper terminals is also burdened by serious financial and intra-European cooperation obstacles.

Conclusion - The socio-economic added value of networks in Europe can be assessed by operationalising the pentagon of concerns and by using environmental policy scenarios for European freight flows. In this context, the final recommendations emerging from our case study suggest that the development of a policy for removing the financial and hardware technical barriers is the main priority, since multi-modal freight transport emerges as a promising evolution in economic, social and environmental terms. Such a policy may have a European (international) perspective which takes into account the particular national characteristics in each country. In this framework, the adoption of common technical standards for railways operation and the introduction of new financial schemes emerges as prerequisites. On the other hand, such development requires new legislation and social adjustments concerning the market structure, the management and the ownership of enterprises and infrastructure in the transport sector.

In the light of the capacity of the current European networks for commodity transport in an integrating economy and in the light of the unacceptably high environmental stress of road transport, new logistic systems based on combined transport as a blend of different modalities are necessary. This will increase capacity, reduce congestion and environmental decay, and make the European network economy more efficient. But this outcome requires dedicated policy strategies on both intermodal transport and on transshipment terminals. A more liberalised transport market may increase the efficiency of intermodal transport operations and establish the means by which the environmental externalities can be included. The critical success factors of such a market may be mapped out by the application of survey methods among experts and stakeholders, while using multicriteria and disaggregate choice analysis. The resulting transport flows may be gauged by using neural network analysis,

3.4 *The Role of Actors*

One principal conclusion from the analysis contained in the previous three case studies is that the role of the actors is critical. A comprehensive survey was carried out through a questionnaire survey of some twenty European countries on the actors' strategy towards the integration of networks (Houée, 1995,1997). It was designed to include all those currently involved in decisions relating to the use and integration of networks, and to elicit concerns and opportunities about the future.

At the national level the state still has a dominant role in determining investment priorities for the infrastructure, even though powers are being devolved to regions and to autonomous agencies. It is not just in decisions on investment, but the state controls finances (or access to finance), regulations and taxation. This strategic role also affects the level of integration in networks, but here the experience of different countries is very variable with some having clear central direction, whilst others take a more permissive role as integration and other leave it to the market. The role of autonomous agencies is fairly widespread with respect to ports and airports, but less common for railways and roads. The state has a key role here in ownership and the provision of services, although in some countries the use of contracts and tendering procedures are become more common as the state gradually withdraws from service provision.

The role of the regions reflects that of the state at the more local level. Rather than investing in the network, the regions' primary concern is in the maintenance of the network and in the provision of services on the network. In some countries, the regions have powers to raise capital, but in others they are restricted to seeking state funding. The regions have only a minor role in the integration of networks as their powers and financing opportunities are limited. Perhaps there is a major role that the regions could play in providing information and advice on the optimal use of the networks to passengers and freight hauliers.

The role of financial institutions and private capital in the construction of infrastructure is limited, except where there are government guarantees. Some potential exists on small to medium scale projects where the risks are low and there are good prospects for returns on investments (e.g. bridges and tunnels). The greatest potential for private

sector involvement in infrastructure investment is through joint ventures between the public and private sectors (Banister, Gérardin and Viegas, 1998).

The survey has not found an important role for the major transport operators in the integration of networks. The tendency has been towards greater fragmentation as operators seek to increase their market share at the expense of their competitors. This conclusion relates primarily to the lack of horizontal integration, which is particularly apparent at the interfaces between modes. However, there are some promising examples of greater cooperation through such schemes as park and ride, combined transport and better transfer facilities (including interchanges). The role of the trade unions is very variable as their power is considerable in some countries, but it has been substantially reduced in others. Modernisation is supported by the unions provided that jobs are safeguarded and working conditions improved.

The power of environmental lobbies is again variable between the countries surveyed. Their general influence may be limited, but they are still powerful when focused on particular issues (e.g. a new road or new runway capacity). Similarly, the industry lobbies are still influential when economic factors are debated, particularly jobs, but it is the environmental lobbyists that seem to be more effective in their methods and in influencing opinion on the choices to be made in the transport sector.

The role of shippers is substantial in achieving network integration and in providing door-to-door services, and they have been effective in providing intermodal services. This is particularly important in light of the disintegration of other types of operators. This change has been facilitated by the new logistics, the new integrators (e.g. express delivery) and the requirements of the service sector for immediate response. but often at a premium price. In the initial stage this has led to market opportunities for the integrators to establish dominance in a growing market. In the second phase, alliances have been sought to give manufacturers a complete package for supply/distribution/marketing. This may lead to mergers and the development of global integrators or fixers. The unresolved third phase is whether the market for these new actors is sufficiently large or diverse for it to be contestable. The length and complexity of the supply chains means that there may be opportunities for specialist inputs, where complementarity between supply chains exist or where specialist skills are required to avoid bottlenecks. So the global operators may need local specialist inputs to ensure continuity in the supply chain. However, too many inputs may reduce the effectiveness of the whole process, and in turn lead to higher costs and fragmentation. It is here that the logistics platforms have a crucial role to play in ensuring the weakest points in the chain (the interchanges) operate efficiently (Banister, 1996).

Another set of new actors has arisen in the leisure sector, principally through multi-modal tour operators. Services are again becoming more tailored to the individual at a premium price, rather than being offered as a cheap package. Quality seems to be a key objective. Individual companies are also providing their own integrated distribution networks. making optimal use of their own vehicles, the information highway and the relatively low costs of transport.

Conclusions - In summary, the survey found that the role of the state (and the EU) is crucial in providing the framework and direction for policy, including regulation, finance, investment, integration and operation of the network. The regions have less of an instrumental role, but more responsibilities for the maintenance of the infrastructure and provision of services. The private sector has a limited role in investment, unless in partnership with the state or in particular projects where risks can be shared. It has a much greater role in the provision of services. Operators are more concerned over their own market share, rather than the integration of the network. Recent changes (e.g. deregulation and privatisation) have led to fragmentation of services, particularly between modes, but also within individual modes.

Environmental and industrial actors are powerful, particularly when focused on single issues or on the employment implications of actions. Shippers have an instrumental role in providing effectively door-to-door services, particularly where intermodal services are required. This is a major growth area with the use of logistics and the emergence of new integrators. The growth in leisure-based activities again offers new opportunities for integrated service provision to a new market,

More generally, one of the main findings of the survey was the increased flexibility in the use of the network. Patterns of use changed daily as requirements of travellers and businesses also changed - this has resulted in the emergence of a large number of small scale creative new actors. The market is in a transition phase from one based on more traditional actors based in manufacturing and highly structured forms of distribution, together with regularised travel patterns, to one that is flexible and based on the new service and information economy, with flat slim-lined organisational structures and very variable patterns of travel demand. The new operators will be the customers themselves as supply chains and demand patterns become increasingly personalised. Interactions will take place directly with the providers of goods and services (e.g. through the intemet) - the whole system is customer driven.

If these revolutionary changes take place, then the concepts of integration also changes as infrastructure networks become more varied and as general networks are replaced by individual ones. Integration has been seen as a collective responsibility to provide the most efficient service for all users. But now it may be an individual responsibility that requires a particular service to a particular user at a particular time to meet a specific set of requirements. The requirements are the use made of the network will change according to internal and external factors in a dynamic way.

The role of the actors in determining the access to the network and the use made of it is reflected in the figure at the end of this report. The dynamics of change have been underestimated and the role of existing and new actors is also in the process of transformation. Traditional views of a small group of influential decision makers are being replaced by an infinitely flexible arrangement where each person, in each location on each day is an actor in determining both how they use the network, and as a consequence of their individual actions they affect the decisions of others on how they use (or do not use) the same network. Actors, individual and collectively, are instrumental in our understanding of how networks are used.

4. Conclusions

Inevitably, there are a wide ranging set of conclusions that have arisen. In the previous section (Section 3), the individual results from each of the four case studies have been placed within the evaluation framework (Section 2). In this section, the overall conclusions are presented where the findings cut across the four case studies.

The net result of these changes and the dynamics of the processes has meant that the use of the European strategic transport network is in a state of rapid adjustment. The value added is not from the physical use of the transport network as this forms a declining part of the total production process, but value comes from flexible production processes, new users of the network, out-sourcing and decentralisation, together with fundamental changes in organisation and management processes.

Transport intensity has grown as both tonne-kms and passenger-kms are increasing at a greater rate than the growth in the European economy. Because transport costs are low, this is one part of the production and movement processes that can be increased so that the overall levels of efficiency and value added to the product or traveller are also increased, at least in terms of the provider of the service. The wider social costs of the dramatic increase in transport intensity of movement are paid by society as a whole. Three main cross-cutting conclusions are presented.

3. I Networks and Integration

Throughout this research, it has been realised that networks are much wider than the physical infrastructure which is conventionally considered within evaluation. The starting point was the pentagon of concerns, but this has been extended to cover evaluation of policies, programmes and projects, and the crucial role that actors have in the construction and use of all forms of networks. Actors have a key role to play in network efficiency and the new range of actors, particularly the integrators, add value to the networks.

Network integration is demand led within a market environment. Although the actors can facilitate integration through regulation, price, location and other complementary policies, it is the user of the network which primarily determines the level of integration. The freight sector best illustrates this conclusion through its reorganisation - value added is in the form of the new flexible production processes with outsourcing and decentralisation, together with new management structures. It seems likely that other sectors (e.g. passenger) will adapt in the same way so that the integrated services will respond to the demand of users for high quality "seamless" travel (e.g. in the leisure sector) - this is the customer driven network.

Full network integration requires a linking of transport networks, together with economic, cultural and other networks. All of these networks interrelate, and it is difficult to apply one form of evaluation. Even if it was possible to develop a unified evaluation tool for network integration, the product is likely to be technocratic and only able to tackle part of the problem. This is a feature of current methods which mainly address a single mode in the context of a single project with only one (or a few) impacts (e.g. the physical infrastructure). A multiplicity of approaches and methods

can be proposed (Section 4.2) and the analysis carried out concentrates on the functioning of networks in particular contexts, The organisational dimension of the pentagon of concerns is crucial in the evaluation of the value added from the European transport network.

One unresolved issue is that a necessary condition for the efficient use of networks is the requirement for high quality data, so that decisions are based on the best possible information. Within competitive markets, this is difficult as data have a high value and as competitive advantage may rely on exclusive access to information. Further research is required to assess the overall EU-wide benefits of decisions being made on full knowledge and the best available data, as compared with individual actions based on partial knowledge and information, **It** is increasingly important that decisions are based on full knowledge and information, and that the most appropriate technology is used if network efficiency is to be improved. The maximum societal value added could then coincide with the maximum individual value added.

4.2 Evaluation and Methods

Across and within all four case studies, a multiplicity of evaluation methods have been used. This is in stark contrast to the starting point of the research where it was proposed to develop a single evaluation tool. It was found that a unique evaluation method is neither feasible nor desirable. As all four case studies opted for a comprehensive evaluation of the various aspects of a network (project, program, policy level, and the pentagon of concerns), a single method could not comprehend the complexity of the evaluation task. Various individual methods are very precise on single aspects and it is not desirable to lose this precision.

Consequently, this multi method strategy has proven to be essential to our understanding of the key components of evaluation rather than a common logic for ordering the evidence. This has been found along the two dimensions, namely the evaluation/decision level (actors perspective) and the pentagon of concerns (factors perspective). There is no single valued relationship either between evaluation/decision level and type of method, or between the diverse dimensions of the pentagon and the kind of approach used. On the contrary, a methodological conclusion from this research is that at any object level it pays to apply either more than one method or to use non orthodox approaches. In concrete terms, this means that it is necessary to analyse actors' behaviour in a policy context using a policy network approach and a microeconomic approach, or to evaluate aggregate impacts on a project level, as well as behavioural aspects on a programme level.

Obviously, the above implies that the action has taken a political economic view on the evaluation task in the case of networks. Evaluation needs to consider the potential for actors to exploit new opportunities to give them a comparative advantage or to profit by providing services – and this applies in both core and peripheral areas in Europe.

4.3 Globalisation and Internationalisation

One of the principle factors affecting the development of transport in Europe has been the increasing internationalisation and globalisation of economic activity. This acts as

both a cause and effect of changes in transport. As a cause it leads to changing patterns of demand and flow as multinational companies alter their patterns of investment in the global market, Thus the transport system has to change to meet these changing needs, and governments at all levels are conscious of the need to respond in anticipation of new investment to ensure the investment takes place. As an effect, these changes in the transport system, which both confirm the centrality of some locations and open up others, present new possibilities to the internationalising firm resulting in new clusters of activity.

This internationalisation occurs both within Europe and between Europe and the rest of the world. Within Europe, firms from one country are involved in new investment in another country, but at the same time there are non European firms investing within Europe. In the latter case the investment is seen as evidence of the increasing attractiveness of European locations for production (i.e. increasing competitiveness). In the former case, it not only reflects changes in "competitiveness" between different regions within Europe, it also has effects on the process of convergence or divergence in the economic performance of these regions (i.e. cohesion). In both cases decisions which have a significant impact on the transport network in any region are being taken outside the region most affected, the distribution of power and control is thus crucial to efficient decisions about new investments, how they are financed, their detailed planning and their operation.

The restructuring of industry within Europe is part of a world-wide process of change, involving the introduction of new technology and new patterns of production to existing sectors, and the introduction of new, more customer oriented services. This is seen in various ways. Traditional manufacturing is concentrated in fewer, larger plants, controlled by fewer multinational enterprises, Large investments are made depending on a variety of local conditions, of which good transport is only one. These are investments which can be less permanent than in traditional sectors, adding further to the loss of control by actors within a particular region or country. However, such investments may have very specific infrastructure requirements which become part of the package necessary to attract large investments into a region. Improved local transport, better telecommunications, airport and seaport investment all feature strongly in this, with new competition between regions being created.

Hence it is not sufficient just to identify the balance of critical concerns from the pentagon used as a starting point in this study, nor even a simple division into the scale of the impact and the identification of the responsible level for decision making. Actors and their influence cut across all of these concerns. These influences involve competition between actors for favoured locations and preferential access to improved networks, competition between regions within Europe and between Europe and the rest of the world for new investment.

Policy actions and reactions by government authorities and other agents at all levels, local, regional, national and supranational (e.g. European Union) become as important as the physical environment and the structure of networks which were previously seen as the major barriers. Understanding the constraints placed on the choices available to policy and decision makers at all levels is the most critical success factor. This is the main lesson for the integration of strategic transport networks in Europe.

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